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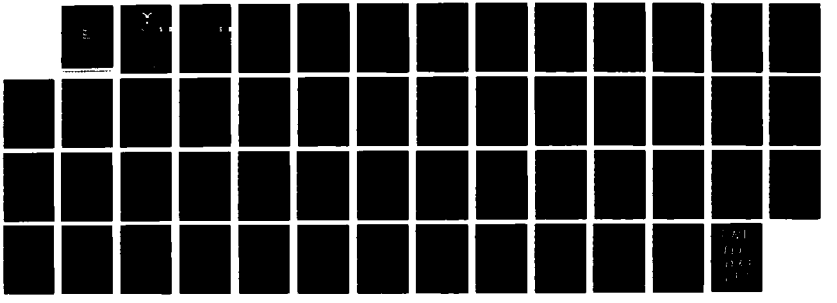

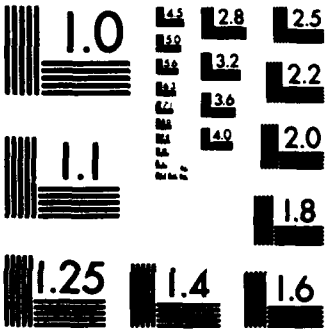

PREDICTION OF ACADEMIC SUCCESS IN THE AIRMAN EDUCATION AND COMMISSIONING PROGRAM: A VALIDITY STUDY

THESIS

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Captain, USAF

AFIT/GLM/LSR/87S-43

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AFIT/GLM/LSR/87S-43

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THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science Logistics Management

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To my fellow classmates and friends, I offer thanks for their help and best wishes in their future endeavors.

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Abstract

This study evaluates the effectiveness of procedures used to select eligible applicants for the Airman Education and Commissioning Program (AECP). Predictors used by AFIT, as well as several new potentially effective predictors were evaluated using a standard criteria-related validity paradigm. These predictor variables are: AFOQT test composite scores, completed college credits, and undergraduate grade point average.

Using a sample of 802 cases, from a period of 1979 to 1984, predictor/criteria relationships were demonstrated for the AECP. Prediction models were developed using R-square and Cp analysis. These models were evaluated as to their applicability to current selection procedures. Validity information, correlation matrices, and a prediction model are presented.

PREDICTION OF ACADEMIC SUCCESS IN THE AIRMAN EDUCATION AND COMMISSIONING PROGRAM: A VALIDITY STUDY

I. Introduction

Technology changes rapidly in the United States Air Force and with those changes comes the need for better trained and highly motivated personnel. Recent statistics show that 99% of the active-duty non-prior service accessions to the Air Force for fiscal year 1985 had high school diplomas (Correll, 1986:63). This rate is the highest of any branch of service in the United States Armed Forces. In order to satisfy the need for further educational opportunities and to develop the potential in these outstanding airmen, many continuing education programs are made available by the Air Force.

A program of particular interest is the Airman Education and Commissioning Program (AECP). This program, administered by the Air Force Institute of Technology (AFIT), allows an airman on active duty to earn his baccalaureate degree in a full time degree curriculum. Individuals selected to the program enroll in civilian institutions to complete their degrees in needed fields of study, primarily engineering. Upon graduation, the selectees are sent to Officer Training School (OTS) in order

to complete their military training and earn a reserve commission.

The AECP is conducted in three phases: Phase 1 - Selection, Phase 2 - Academic, and Phase 3 - Military. During the selection phase, an eligible airman submits his application package to AFIT's division of evaluation and counseling. Eligibility requirements are contained at Appendix A. AFIT reviews the requests and issues a letter of academic eligibility or guidance on what course of action is required to achieve eligibility (Department of the Air Force, 1984:3).

The eligible airman submits his application to be reviewed by the AECP selection board which convenes each February and September. The board is composed of three officers: the Director of Personnel Procurement serving as the board president, another active duty colonel and one colonel from the reserves. Only those applicants qualified for commissioning and certified by AFIT as academically eligible meet the board. The applicants are evaluated by the AECP selection board based on the following considerations (Wright, 1987b):

a. the number of college hours completed.

b. scores from the Scholastic Aptitude (SAT) or the American College Test (ACT).

c. scores from the College Level Examination - Subject Examination.

d. AFOQT scores, minimum of 15 on the verbal composite

and 10 on the quantitative composite are required.

e. College and high school transcripts.

f. Commander's evaluation/recommendation, AF Form 1145.

g. Airman Performance Reports.

In the Academic Phase, the selected applicants are placed in an academic program needed by the Air Force in a civilian institution. This phase is administered by AFIT and usually does not last more than 36 consecutive months (Department of the Air Force, 1984:3).

Airmen who complete the Academic phase, enter the military Phase and are assigned to their new unit with temporary duty en route at Officer Training School (OTS) for precommissioning training (Department of the Air Force, 1984:3).

The Air Force Institute of Technology, Admissions Office, is concerned with the attrition of selectees from the AECP. The Admissions Office is interested in predictors of academic success which will reduce the attrition rate from the AECP. Attrition of AECP students is currently 4% from the academic phase, and 4.2% of the AECP students attrit from the military phase, compared to an overall 11.8% attrition rate from OTS (Wright, 1987c). The high cost of the AECP, estimated at an average of $55,239 per student by the Admissions Office, has prompted the research into this area. Other commissioning programs, The United States Air Force Academy and the Reserve Officer Training Corps, cost

significantly more to train students, however the nature of the AECP and the technical engineering disciplines pursued by the applicants makes attrition from AECP costly.

Selection to the AECP is highly competitive and only those applcants with the best overall records who meet the criteria established by the selection boards are successful. The 1987 selection board selected 37 individuals from a total of 204 applicants, an 18% selection rate. Since selection is based on the "total person" concept (Wright, 1987a), there are no minimum scores required for the entrance examinations, with the exception of the AFOQT. The board selects those applicants that meet the whole person concept desired by the Air Force and have the best overall records. A primary consideration is given to officer potential when board members review the individual's application and substantial weight is given to the applicants' AF Form 1145, Commanders Evaluation/Recommendation.

Various test scores are used by the AFIT Admissions Office in making selections to the AECP. AFOQT scores and undergraduate grade point average are heavily weighted in the selection process, and play a large part in the quantitative portion of an applicant's eligibility.

Problem Statement

The relationships between the various indicators of student potential and making predictions regarding their

academic success have not been proven. The validity of the AFOQT and undergraduate grade point average, from the first two years of college, as predictors of academic success in the AECP has not been established. This study will provide the Admissions Office with some empirical findings with regard to their selection process and evaluation techniques. The principal purpose of this study is to evaluate the criterion - related validity of the selection criteria and other potential predictors of academic success of selectees to the AECP. The validity of the current selection process will be analyzed and prediction models will be developed which may improve the Admissions Office selection process.

Background

The criterion - related validity of grade point averages in predicting student success in undergraduate college education has been the subject of many studies. However, the use of the AFOQT in the same sense has not received any attention. High school grade point average is the single best predictor of how a student will do in college (Astin, 1971:4-12). Research done in determining the characteristics that predict academic performance found that women do better than men in college, that those students with a high grade point average in high school also had a high grade point average in college, and that other tests of academic ability expressed a positive relationship

between performance in high school and performance in college (Astin, 1971:4-12). Use of the high school record, primarily the high school grade point average, in selecting AECP candidates has not been attempted.

There are several means by which to determine academic success based on personal qualities and academic ability. The traditional academic predictors are the class rank in high school and the college admissions tests. These means are supplemented by various objective measurements, such as high school honors and leadership characteristics, and narrative measurements, such as school references and personal statements. In addition, the admissions staff forms evaluations through interviews, special attributes and talents, and an overall academic rating. Demographic information can also be taken into account in making predictions regarding potential academic success (Willingham, 1985:82). The AECP selection process makes the high school record available to evaluators, however class rank in high school is not a specific criterion evaluated. Since 1984, the Scholastic Aptitude Test (SAT) scores have been part of the selection criteria used. This study is concerned with the selectees who have already completed the program, therefore very few applicants were required to submit SAT scores. The test composites investigated in this study are the Air Force Officers Qualifying Test and the Armed Forces Vocational Aptitude Battery.

Reliability

Test reliability refers to the stability and consistency of the results of tests. Reliability does not measure the effectiveness of the tests themselves, but rather the variability of scores on those tests. Commonly, the term trustworthiness is used in explaining the concept of reliability (Dick and Hagerty, 1971:3).

Reliability expresses a relationship between sets of scores on equivalent tests, administered independently and taken from the same individuals. Reliability coefficients reflect information available when a test is administered not information on the test content (Ebel, 1986:71). It is important to recognize that test validity is limited by the extent of its reliability.

Note that because reliability conceptually correlates a measure with itself, a reliability coefficient is properly interpreted as a coefficient of determination (r^2).

Validity

Test validity indicates how well a test measures what the test was designed to measure.

Criterion-related validity, a general term for both predictive and concurrent validity, attempts to assess the relationship between the test score and the criterion measure, in this case test scores and academic success. It is common practice to predict the criterion of grade point

average using standardized test scores when attempting to forecast the academic success of individuals (Womer, 1968:51).

The use of preadmisssion measures, (e.g., entrance examinations and high school grade point average), are generally less valid in predicting post-freshman grade point average than they are in predicting first year or cumulative grade point average. Also the validity of using the freshman year GPA in predicting the GPA in later years declines as the interval between comparisons gets longer (Wilson, 1983). Investigating the relationship between an applicant's age and time in service at the time of selection to the AECP may have an impact on the applicant's academic success.

In a recent study (Arth, 1986), the validation of the AFOQT for 9,029 non-rated officers was investigated. The AFOQT scores were compared with the final course grade, ranging from a low of 60 to a high of 99, in technical training course to determine students' performance. Only numeric final school grades were used for correlations. AFOQT scores are a major objective component in the selection and classification decisions. The predictor variables were the five composites of the AFOQT and the criterion variable was the final school grade in the course. Pearson product- moment coefficients were computed between each of the five composites and the final course grade. The author concluded from his research that a

majority of the correlations were positive and significant. The correlations range from .01 to .62, with many of them falling between .20 and .40 (Arth, 1986:2).

Performance on the AFOQT was strongly related to success in initial training. Using such information in making selections to training schools as well as career fields, the average training costs could be reduced lowering the academic attrition rate or by shortening the course length, while still maintaining current training achievement levels.

Air Force Officers Qualifying Test

The AFOQT is used by the Admissions Office as a relative measure of academic potential much like college admissions tests. The AFOQT is used by the Air Force to select individuals for officer commissioning programs, with the exception of the United States Air Force Academy. These are Officer Training School (OTS) and Air Force Reserve Officer Training Corps (AFROTC). The test is also used in making selections for such specialized training as pilot and navigator training. Since its initial development in 1951, the AFOQT has been revised fifteen times and is still the basis for the Air Force Officer selection testing program. New forms of the AFOQT are developed on a periodic basis, Form O replaced Form N in 1981, and is the latest version of the test being used.

Throughout the history of the test, five aptitude composites have been used: Pilot, Navigator-Technical, Academic Aptitude, Verbal, and Quantitative. The 380 item test is divided into 16 subtests which undergo constant revision, however the aptitudes that they measure have remained constant. Results from the test are reported in terms of composite percentile scores, which are raw scores converted into percentiles using conversion tables.

Subtest and composite reliabilities and intercorrelations were computed on Form O data, using a combined AFROTC and Non-AFROTC sample of 37,409 cases. The Human Resources Laboratory derived internal consistency reliability coefficients using the Kuder-Richardson Formula 20 for the sixteen subtests. Kuder-Richardson Formula 20 is used to determine internal consistency reliability values when the test has only been administered once (Dick and Hagerty, 1971:31). The subtests were then combined to form the five composites and the reliabilities of the composites were based on a formula developed by Wherry and Gaylord. Reliabilities of the sixteen subtests range from .699 to .925 and for the five composites the reliabilities range from .919 to .967. The standard error for the subtests ranges from 1.197 to 2.70 and the standard error of measurement for the composites range from 3.455 to 6.657. Intercorrelation matrices of Pearson product-moment correlations were computed for the subtest and composite raw scores. Subtest intercorrelation varied from .169 to .729

and composite intercorrelations are consistently high at greater than .60 (Rogers, and others, 1986b:6-9).

The use of such quantitative measures in a selection process yield several benefits. The applicants are easily evaluated based on quantitative measures because the numbers can be put into a formula and compared. In addition, quantitative numbers add credibility to the selection method.

The AFOQT has received some attention in its use as a predictor of success in areas such as military technical schools (Finegold, 1985), selection to rated jobs (Valentine, 1977 and Miller, 1986) and selection to non-rated jobs (Arth, 1985).

Armed Services Vocational Aptitude Battery

The United States Armed Forces have used ability test batteries in making personnel selection and classification decisions since early in this century. The instrument currently being used in making these decisions is the Armed Services Vocational Aptitude Battery Forms 11a, 11b, 12a, 12b, 13a, 13b (Prestwood, 1985:11), its initial reference population was a World War II sample of 800,000 males who were in the services in 1944 (Wegner, 1985). Since 1980, the ASVAB has consisted of ten individual subtests. These subtests are: General Science, Arithmetic Reasoning, Word Knowledge, Paragraph Comprehension, Numerical Operations, Coding Speed, Auto and Shop Information, Mathematics

Knowledge, Mechanical Comprehension, and Electronics Information. Scores from four of the subtests are used to compute an Armed Forces Qualificatio Test (AFQT) composite score. The AFQT score is used to determine whether an applicant is qualified for enlistment. Other composite scores, computed using scores from two or more subtests, are used to determine qualifications of enlistees for training in different occupational specialties in the various services. Examples of such applications include studies to improve the selection, classification and utilization of Army enlisted personnel (Human Resources Research Organization, 1985); a study conducted to investigate characteristics of U. S. Navy recruits on reading comprehension and educationally related variables (Bowman, 1986); and a U. S. Marine study to predict training success of men and women in clerical specialties (Dunbar and Novick, 1985).

Like the AFOQT, the ASVAB is routinely updated to maintain test security, replace items that become obsolete, and take advantage of advances in the field of pyschological measurement (Ree, Mullins, Mathews, and Massey, 1982). New forms of the ASVAB are equated to a reference test in order to place scores from the new forms on a common normative scale. This provides a consistent meaning for the scores used and consistency in selection and classsification (Ree, et al., 1982).

This study, through the use of the AFOQT and ASVAB test composite scores, will develop a model of predicting academic success in the Airman Education and Commissioning Program.

Research Hypotheses

1. The AFOQT and ASVAB composite test scores are valid predictors of undergraduate grade point average and success in the Airman Education and Commissioning Program.
2. The current selection procedures used by the Air Force Institute of Technology to select applicants to the Airman Education and Commissioning Program can be improved by using a predictive model developed through this study.
3. There are other variables, predictors of success, that contribute to the success of selectees to the Airman Education and Commissioning Program.

II. Method

Subjects

The subjects in this study include all selectees to the AECP from 1979 to 1984, inclusive. This time period was studied because it includes those selectees who, at the time of this study, have completed both the academic and military phases of the AECP. The information collected includes selection criteria and demographic data for as many of the selectees as possible. The total data base includes 802 records. Some records were not complete, however the total number of records with missing data was not large and should not affect the results. Missing data values occured in 9 records for AFOQT scores, 3 ASVAB scores, and 1 CCAF.

Measures

The list contained in Table 1 will be used in lieu of the actual variable names for brevity and ease. All information was current at the time of selection to the AECP.

Table 1. Definition of Variables

AFOQTA	AFOQT Academic Aptitude Composite
AFOQTQ	AFOQT Quantitative Composite
AFOQTV	AFOQT Verbal Composite
ASVABA	ASVAB Administrative Composite
ASVABE	ASVAB Electrical Composite
ASVABG	ASVAB General Composite
ASVABM	ASVAB Mechanical Composite
GPA	Undergraduate Grade Point Average
MS	Marital Status
SEX	Male/Female
CC	Undergraduate College Credits Completed
CCAF	Community College of the Air Force Credits Completed
TAF	Number of Years in the Service
RANK	Rank at time of selection
AGE	Age at time of selection

Data Analysis

The data collected for this study was obtained from the Air Force Institute of Technoloy's Admissions Office. The database includes the applicant's selection date to AECP, rank at the time of selection, date of entering the Air Force, marital status, sex, the Major Command the applicant was assigned to at the time of selection, the number of

undergraduate credit hours completed at the time of selection, the number of Community College of the Air Force credits completed at the time of selection, undergraduate grade point average at the time of selection, Armed Services Vocational Aptitude Battery scores, and the Air Force Officers Qualifying Test scores.

The Scholastic Aptitude Test (SAT) scores were not required from applicants until 1984, therefore this study did not investigate their affect on academic success of AECP students.

Only those applicants who were accepted to the AECP and successfully completed the program were studied. Information on those individuals who were disenrolled from either the academic phase or the military phase of the AECP were unavailable for analysis, and are not contained in this study. It is recognized that this is a serious flaw, due to restriction in range in the criterion measure, in the research conducted. Unfortunately, information regarding selectees to AECP who have since been disenrolled are not maintained in the Admissions Office files.

Conversion of the AFOQT and ASVAB Test Scores

The data for the AFOQT and the ASVAB were only available in percentile form, therefore it was necessary to convert all of the percentile data to original raw score form. Raw scores are more valuable in developing predictive models because they contain the original distribution of

scores and they can be used to make more accurate comparisons among different year groups of test takers. Information obtained from the Air Force Human Resources Laboratory was used in converting the AFOQT composites (Rogers, et al., 1986b:13-15). The conversion tables were analyzed using regression analysis to develop a linear model for both the AFOQT Forms N and O, and the ASVAB tests. Information regarding which form of the AFOQT each applicant took was unavailable, all of the scores were converted using the Form O conversion information. Thus, to the degree that Forms N and O ranked individuals similarly, the prediction information is presented in terms of the current test (Form O).

Developing Prediction Models

Using the Statistical Analysis System software (SAS) on a VAX 11/785 mainframe, PROC RSQUARE and Cp procedures were used in calculating the best prediction models. These procedures were used because they make an analysis of the r-square values, the contribution of each variable to the model and ultimately give the final best model, for some specific number of variables, maximizing the r-square value. Cp analysis was used to find the model with the optimum number of variables. Use of Cp analysis was proposed as a statistic by Mallows as a means for selecting a model.

Cp is a measure of the total mean squared error defined as:

$$Cp = SSEp/s^2 - (N-2p)$$

where: Cp = Mallows statistic

s^2 = mean squared error for full model

SSEp = sum of squares for the model

p = number of variables, including the intercept

Mallow also suggests graphing the Cp with p; the selected model is the one where the value for the Cp first approaches p. A Cp value near p, suggests a model with unbiased parameter estimates (SAS, 1985:765).

Since some of the independent variables used in the regression models were highly intercorrelated, the liklihood of multi-collinearity inducing a blocking effect on the introduction of subsequent independent variables into the model had to be considered. To prevent a variable that was highly correlated with both the dependent variable and the other independent variables from reducing the overall multiple correlation coefficient, the independent variables were systematically dropped from the equation on successive iterations.

The "best" model for this study was chosen from a number of models indentified through the PROC RSQUARE and Cp analysis. These models are reported in Chapter 3.

III. Results

This chapter is presented in several sections. First, the results of the data conversion process are reported. Next, a comparison of the existing correlations is made. Section three describes the present selection procedures used in selecting AECP students, followed by a short validity section on that procedure. The fourth section presents the results of the model development conducted. The fifth section describes the best model, reasons for its superiority, and methods for using the model. The final section is composed of an economic impact of changing the selection process.

Conversion of Predictors

The conversion tables avilable from the Air Force Human Resources Laboratory (Rogers, et al., 1986b:13-15) on AFOQT Test Form O and the conversion tables available on the ASVAB composites were used to develop regression formulas. These regression formulas were used to convert the percentile data to its raw form as discussed in Chapter II. The Statistical Analysis System Programming Language was used to calculate the slope and y-intercept values for regression formulas. The data were then plotted to inspect for linearity; all test composites exhibited a linear relationship when

plotted. The results of this conversion process are contained in Tables 2 and 3.

Table 2. Conversion Information for AFOQT Composites

Composite	slope	y-int	F-value	R-square	Significance
AFOQTA	.875	39.37	2591.9	.97	.0001
AFOQTQ	.474	15.77	2559.8	.98	.0001
AFOQTV	.53	16.45	2240.8	.98	.0001

Composite	N	Mean	Std Dev	Minimum	Maximum
AFOQTA	794	100	17.2	44	126
AFOQTQ	794	50	8.6	21	62
AFOQTV	794	51	11.9	22	69

Table 2 displays the slope and y-intercept values that were used to derive the formulas used to convert the percentile data to raw scores. It also shows the strength of the linear relationship between the percentile scores and the raw scores. The high F-values and R-square values, along with the significance level show that the linear relationship appears to be strong.

F-values are the ratio of the model mean square to the error mean square. The higher the value the better the fit of the regression line to the data points; it means that there appears to be little deviation of the data points around the regression line. The R-square value represents the proportion of variance in one of the variables that can be explained by variation in the other variable. The higher

the R-square value, the greater the proportion of variance that can be explained by variance in the dependent variable (Cody and Smith, 1985:62).

Table 3. Conversion Information for ASVAB Composites

Composite	slope	y-int	F-value	R-square	Significance
ASVABA	.87	105.9	774	.91	.0001
ASVABE	1.22	137.8	7758	.99	.0001
ASVABG	.65	66.6	1513	.96	.0001
ASVABM	1.24	137.2	5989	.98	.0001

Composite	N	Mean	Std Dev	Minimum	Maximum
ASVABA	801	175	13.1	123	189
ASVABE	801	243	13.3	168	254
ASVABG	801	122	7.3	93	130
ASVABM	801	231	22.5	143	255

Table 3 shows the slope and y-intercept values that were used to derive the formulas used to convert the percentile data to raw scores for the ASVAB composites. It also shows the strength of the linear relationship between the percentile scores and raw scores. The high F-values and R-square values, along with the low significance levels, show that the linear relationship appears to be strong.

Correlation Discussion

Information regarding the Air Force Officer Qualifying Test reliabilities and intercorrelation is presented at Appendix B.

Subsequent to the conversion of the percentile scores, correlation matrices containing all the predictor variables were computed over the entire sample. The correlation matrix for the entire sample in contained in Appendix C. The correlations between each of the fourteen predictor variables and GPA are shown in Table 4. The correlation coefficient, significance level and sample size for each variable are shown.

Table 4. Correlations of Predictors with GPA

Variable	AGE	RANK	TAF	MS
Correlation	-0.12	0.16	0.08	-0.07
Significance	0.00	0.00	0.03	0.04
Sample Size	801	802	800	802

Variable	SEX	CC	CCAF
Correlation	0.03	-0.43	0.15
Significance	0.44	0.00	0.00
Sample Size	802	802	801

Variable	ASVABA	ASVABE	ASVABG	ASVABM
Correlation	-0.11	-0.10	-0.11	-0.08
Significance	0.00	0.00	0.00	0.02
Sample Size	799	799	799	799

Variable	AFOQTA	AFOQTQ	AFOQTV
Correlation	0.02	0.02	0.03
Significance	0.64	0.49	0.40
Sample Size	793	793	793

Table 4 indicates that of all the predictors of GPA, RANK and CCAF have the strongest positive correlation, while CC has the strongest negative correlation. Of all of the measures, there are none that appear to have a strong positive correlation.

Selection Procedures for AECP

As discussed in Chapter I, a wide variety of information is considered by the selection board when evaluating an applicant for admission to the AECP. For review purposes, those criteria are:

number of college credits completed
SAT and ACT test scores
CLEP-SE test scores
AFOQT test scores
College and High School transcripts
AF Form 1145, Commander's Evaluation/Recommendation
Airman Performance Reports

In addition, the use of the "total person" concept also contributes a number of measures that are difficult to quantify, and evaluate as to their contribution for that applicant being selected. For the purposes of this study, success in the AECP is defined as graduating from both the academic phase and the military phase. Approximately 96% of those selected complete the acedemic phase and 96% successfully complete the military phase.

The Models

As a result of the PROC RSQUARE and Cp programs used on the dataset, 157 potential models were developed. Of these models, 8 were selected for analysis because their Cp values were equal to, or fairly close, to the number of independent variables in the model. This is a valid method of selecting models as explained by Mallow (SAS Institute Inc., 1985:795).

Information on these 8 models is displayed in Table 5.

Table 5. Models Selected for Analysis

No. of Var	R-Square	C(P)	Variable Names
8	.2275	7.84	AFOQTA AFOQTQ AFOQTV ASVABE CC CCAF AGE RANK
9	.2282	9.17	AFOQTA AFOQTQ AFOQTV ASVABA ASVABG SEX CC AGE RANK
9	.2283	8.96	AFOQTA AFOQTQ AFOQTV ASVABG ASVABM SEX CC AGE RANK
10	.2291	10.23	AFOQTA AFOQTQ AFOQTV ASVABE ASVABG CC CCAF TAF AGE RANK
10	.2294	9.93	AFOQTA AFOQTQ AFOQTV ASVAGB ASVABM SEX CC CCAF AGE RANK
11	.2301	11.22	AFOQTA AFOQTQ AFOQTV ASVABA ASVABE SEX CC CCAF TAF AGE RANK
12	.2312	12.10	AFOQTA AFOQTQ AFOQTV ASVABE ASVABG ASVABM SEX CC CCAF TAF AGE RANK
12	.2313	12.00	AFOQTA AFOQTQ AFOQTV ASVABA ASVABG ASVABE SEX CC CCAF TAF AGE RANK

Table 5 shows the number of independent variables in the model, the R-square value for that particular model, the Cp value, and the variables that are contained in the model. The number of variables in the model ranges from 8 to 12 variables and the R-square values range from .2275 to .2313. In addition, the most prevalent variables in the model are the AFOQT composites which are in every model.

The Best Model

The best prediction model, the eight variable model, contains the predictors: AFOQTA, AFOQTQ, AFOQTV, ASVABE, CC, CCAF, AGE, AND RANK. This model was selected on the basis of its R-square value, the number of independent variables compared to the Cp value, and by reducing the model to its smallest size with negligible reduction in the R-square value, otherwise known as invoking parsimony.

This model was chosen over the other models because of its comparable R-square value, the number of independent variables is nearly equal to the Cp value, and the relative gain in the R-square value when the model size was reduced. By invoking the concept of parsimony, the model size is reduced from 12 to 8 variables and loses .0038 in the R-square value. This amount appears insignificant when compared to the evaluation time that could be saved by dropping four variables from the selection model.

In using this model to select applicants to the AECP, evaluation must be carefully given to each of the individual

predictors. Although weights are not given, the predictors will have different impacts on the dependent variable. It is necessary to evaluate those variables in the model consistent with their relationship to GPA.

Economic Analysis

It is important to address the economic impact of using the model developed in this study since the objective is to reduce attrition and ultimately save money.

The current selection procedures use a variety of variables, with fairly acceptable results. The current attrition rates of 4% from the academic phase and 4.2% from the military phase of the AECP are not high enough to warrant great concern (Wright, 1987c). It is difficult to estimate attrition levels resulting from use of this 8 variable model. However an analysis of evaluation costs can still be made.

By using an eight variable model, the number of predictors the board is looking at is reduced drastically. This alone saves on data collection, evaluation time and the overall selection time is reduced.

IV. Discussion and Conclusion

A Review of the Hypotheses

Hypotheses One stated that the AFOQT and the ASVAB composite test scores are valid prdictors of grade point average, and success, in the Airman Education and Commissioning Program. In fact, the research shows that this is not true. Pearson product-moment coefficients for the AFOQT composites as each relates to GPA ranges from .017, significance of .64, to .030, significance of .40. The correlation coefficients indicate that there appears to be a weak relationship between the AFOQT composites and GPA. The coefficients for the ASVAB composites ranges from -.112, significance of .00, to -.079, significance of .02. There appears to be a slightly negative correlation between how an applicant scores on the ASVAB composites and his GPA in undergraduate work. Thus, AECP students with lower ASVAB scores tend to get higher GPAs.

Hypothesis Two stated that the selection procedures used by the Air Force Institute of Technology to select applicants to the AECP can be improved by using a predictive model developed in this study. The data gathered in this study does not necessarily support this hypothesis.

Hypothesis Three stated that there are other variables, predictors of success, that contribute to the success of selectees to the AECP. By evaluating the total person

concept, it can be shown that this study supports this hypothesis.

Discussion

This study demonstrates the method of criterion related validity. The correlation coefficients calculated show that various predictor variables can contribute to success in the AECP. Prediction models developed as a result of the r-square and Cp procedures show the dependent variable, undergraduate grade point average, is correlated with various predictor variables. Some of the relationships are negative, but a majority of them contribute in a positive manner.

The use of a predictive model can yield several benefits. By making good use of the data available to the Admissions office, accurate selections to the AECP can be made. The best model, identified in Chapter 3, contains information currently collected by the Admissions office and contains AFOQT test composites that measure academic, quantitative, and verbal abilities, the ASVAB test composite that measures Electrical aptitude, the number of undergraduate college credits completed, the number of Community College of the Air Force credits completed and the applicant's age and rank at the time of selection.

It would appear that successful selectees have higher scores on the AFOQT composites, a lower score on the ASVABE

composite, have fewer college credits completed, have some CCAF credits completed, are younger in age and are of lower rank.

Areas for Further Study

This study only evaluated those applicants who were selected to the AECP. In future studies it is suggested that all applicants be studied, both those who were successful and those who were unsuccessful in completing the program. By investigating both successful and unsuccessful selectees, restriction in range problems are reduced. Conducting the same study on a much larger sample, better criterion related validity correlations may result. This study was not all inclusive but did present some valid models to consider.

Another area to consider for future study is that of the eligibility criteria required by the Admissions Office prior to an applicant being considered for evaluation. The high school record, Scholastic Aptitude Test (SAT) scores or American College Test (ACT) scores, and freshman year college performance should be looked at more closely in establishing eligibility requirements. In further studies, the contribution of the SAT would be a good area of research.

The final area suggested for further study is that of the total person concept. The total person concept allows virtually any variable to enter into the selection of

applicants. These variables are unquantifiable and vary between selection board members. As an example, board members are asked to evaluate an applicant's potential to be a good officer based on his commander's evaluation and recommendation, as well as any letters of recommendation. This procedure relies on many different evaluator's value systems and is prey to individual subjectivity.

Conclusions

The AFOQT test composites do not appear to be statistically significant in the prediction of academic success of AECP selectees. The ASVAB composites are more significant and appear to be stronger in their relationship with GPA.

In addition, other variables impact the selection process as a result of using the total person concept in the evaluation of applicants to the AECP. As an area of further research it is suggested that this total person concept of selection be investigated. To further expand on the concept of the total person evaluation process, it is also recommended that the military phase of the AECP be studied. This thesis focused on the acacemic phase of the AECP, but equally important is the attrition from the military phase.

Appendix A. Airman Education and Commissioning Program Eligibility Criteria

In order for an airman to be eligible for the AECP, the airman:

a. must be a regular ariman with at least on year of continuous active duty.

b. must be a citizen of the United States.

c. must be less than thirty years of age at the time of application. Waivers are granted to those outstanding and deserving airmen who will complete the military phase by age thirty five.

d. is of good moral character and have personal qualities desired of a commissioned officer.

e. be recommended for commissioning by his unit commander.

f. have a letter of academic eligibility from the Air Force Institute of Technology.

Airmen request letters of academic eligibility formally from AFIT by submitting:

a. United States Armed Forces Institute (USAFI) transcripts and college level examination program - subject examination (CLEP-SE) scores.

b. Two copies of high school and college transcripts, as well as a resume of the college classes currently being taken or will be taken prior to the board convening.

c. Air Force Officer Qualifying Test (AFOQT) scores.

d. Report of Individual Personnel (RIP) and records review list.

e. Test results from either the Scholastic Aptitude Test (SAT) or the American College Test (ACT). These scores must be less than two years old.

AFIT reviews the requests and issues a letter of academic eligibility or guidance on what course of action is required to achieve eligibility (Department of the Air Force, 1984:3).

Appendix B. Air Force Officers Qualifying Test Reliabilities and Intercorrelation Information

Reliabilities and Standard Errors of Measurement for AFOQT Form O Subtests

Subtest	Reliability	SEM
Verbal Analogies	.796	1.915
Arithmetic Reasoning	.804	1.944
Reading Comprehension	.885	2.031
Data Interpretation	.719	2.104
Word Knowledge	.882	2.013
Math Knowledge	.867	2.144
Mechanical Comprehension	.712	1.975
Electrical Maze	.809	1.822
Scale Reading	.839	2.700
Instrument Comprehension	.844	1.912
Block Counting	.837	1.793
Table Reading	.925	1.197
Aviation Information	.794	1.961
Rotated Blocks	.769	1.600
General Science	.699	1.992
Hidden Figures	.701	1.547

(Source: Rogers, et al., 1986b)

Reliabilities and Stadard Errors of Measurement for AFOQT Form O Composites

Composite	Reliability	SEM
Pilot	.964	5.395
Navigator-Technical	.967	6.657
Academic Aptitude	.959	4.963
Verbal	.944	3.455
Quantitative	.919	3.575

(Source: Rogers, et al., 1986b)

Subtest Intercorrelations for AFOQT Form O

	VA	AR	RC	DI	WK	MK	MC	EM	SR	IC	BC
VA											
AR	.566										
RC	.729	.653									
DI	.536	.672	.557								
WK	.682	.451	.769	.462							
MK	.534	.711	.505	.603	.404						
MC	.476	.497	.465	.466	.388	.477					
EM	.265	.362	.241	.376	.169	.377	.443				
SR	.481	.681	.462	.636	.361	.624	.497	.443			
IC	.368	.406	.346	.448	.284	.379	.502	.422	.502		
BC	.425	.509	.388	.502	.297	.486	.486	.467	.612	.498	
TR	.344	.450	.355	.466	.261	.453	.313	.321	.556	.372	.519
AI	.340	.316	.365	.359	.331	.264	.508	.283	.363	.581	.316
RB	.404	.453	.329	.408	.257	.459	.544	.412	.499	.466	.542
GS	.510	.473	.536	.437	.507	.525	.570	.336	.424	.420	.365
HF	.363	.368	.319	.372	.262	.370	.383	.337	.443	.358	.450

	TR	AI	RB	GS
AI	.242			
RB	.347	.350		
GS	.263	.465	.409	
HF	.363	.255	.428	.309

(Source: Rogers, et al., 1986b)

Appendix C. Correlation Matrix for the Entire Sample

	RANK	TAF	MS	SEX	CC	CCAF	GPA
AGE	.592	.760	-.229	-.09	.180	.220	-.107
	.00	.00	.00	.01	.00	.00	.00
	803	802	803	803	802	801	801
RANK		.80	-.26	-.19	-.148	.357	.159
		.00	.00	.00	.00	.00	.00
		802	804	804	803	802	802
TAF			-.24	-.17	-.12	.36	.077
			.00	.00	.00	.00	.03
			802	802	801	800	800
MS				.03	.04	-.09	-.073
				.33	.31	.01	.04
				804	803	802	802
SEX					.03	-.12	.027
					.46	.00	.44
					803	802	802
CC						-.22	-.438
						.00	.00
						802	802
CCAF							.154
							.00
							801

Note: Correlation information is presented in this format:
correlation coefficient
siginificance level
sample size

Correlation Matrix for the Entire Sample (cont.)

	AFOQTA	AFOQTQ	AFOQTV	ASVABA	ASVABE	ASVABG	ASVABM
AGE	.077	-.090	.159	.009	.075	-.007	.139
	.03	.01	.00	.80	.03	.85	.00
	793	793	793	800	800	800	800
RANK	-.001	-.091	.049	-.189	-.084	-.186	-.053
	.97	.00	.16	.00	.02	.00	.13
	794	794	794	801	801	801	801
TAF	-.028	-.148	.044	-.104	-.037	-.181	.019
	.42	.00	.21	.00	.29	.00	.59
	792	792	792	799	799	799	799
MS	.086	.112	.045	.110	.016	.938	-.093
	.02	.00	.20	.00	.65	.01	.01
	794	794	794	801	801	801	801
SEX	.015	.005	.038	.112	-.040	.063	-.171
	.67	.89	.29	.00	.25	.07	.00
	794	794	794	800	800	800	800
CC	.050	.002	.084	.171	.101	.170	.076
	.16	.96	.02	.00	.00	.00	.03
	793	793	793	800	800	800	800
CCAF	.073	.003	.099	-.161	.121	-.061	.112
	.04	.93	.01	.00	.00	.09	.00
	792	792	792	799	799	799	799
GPA	.017	.025	.030	-.108	-.103	-.112	-.079
	.64	.49	.40	.00	.00	.00	.00
	793	793	793	799	799	799	799

Note: Correlation information is presented in this format:
correlation coefficient
siginificance level
sample size

Correlation Matrix for the Entire Sample (cont.)

	AFOQTA	AFOQTQ	AFOQTV	ASVABA	ASVABE	ASVABG	ASVABM
AFOQTA	.760 .00 794	.872 .00 794	.332 .00 791	.385 .00 791	.509 .00 791	.274 .00 791	
AFOQTQ		.414 .00 794	.333 .00 791	.352 .00 791	.388 .00 791	.207 .00 791	
AFOQTV			.243 .00 791	.312 .00 791	.457 .00 791	.245 .00 791	
ASVABA				.283 .00 801	.498 .00 801	.157 .00 801	
ASVABE					.536 .00 801	.610 .00 801	
ASVABG						.383 .00 801	

Note: Correlation information is presented in this format:
correlation coefficient
siginificance level
sample size

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ABSTRACT

This study evaluates the effectiveness of procedures used to select eligible applicants for the Airman Education and Commissioning Program (AECP). Predictors used by AFIT, as well as several new potentially effective predictors were evaluated using a standard criteria-related validity paradigm. These predictor variables are: AFOQT test composite scores, completed college credits, and undergraduate grade point average.

Using a sample of 802 cases, from a period of 1979 to 1984, predictor/criteria relationships were demonstrated for the AECP. Prediction models were developed using r-square and Cp analysis. These models were evaluated as to their applicability to current selection procedures. Validity information, correlation matrices, and a prediction model are presented. Keywords:

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